

**Set Name Query**

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result set

*DB=USPT; PLUR=YES; OP=OR*L3 body adj armor and L115 L3L2 matrix adj layer\$ and L11 L2L1 penetration adj resistance and (wire or staple\$)258 L1

END OF SEARCH HISTORY

**WEST**☐ **Generate Collection** **Print**

L3: Entry 3 of 15

File: USPT

Aug 31, 1999

DOCUMENT-IDENTIFIER: US 5943694 A  
TITLE: Specially shaped multilayer armor

Abstract Text (1):

Armor, in particular body armor for female wearers is made of multiple layers (30) of penetration-resistant material for example made of polyaramid fibers, specially shaped to fit over a shaped area to be protected, e.g. the bust of a female wearer. The armor's shaped part is held in shape by a series of darts (37) in successive layers (30) of the material. Each dart in a material layer comprises a generally V-shaped section (35) whose edges (37) are joined to form the dart. The V-shaped section (35) of the material is folded on itself to form a pleat (40) which is folded over to one side of the dart (37) to form an added thickness overlaying or underlying an adjacent part of the material (30). The darts (37) are angularly offset from one another with the pleats (40) oriented in directions so that the added thickness is distributed substantially evenly, thereby avoiding bulges or stiffness and improving the wearing comfort. Preferably, the layers of material are fabric covered over selected areas thereof to be protected with a bonded or coated reinforcing film, except in the folded V-shaped sections.

Brief Summary Text (2):

The invention relates to armor made of multiple layers of penetration-resistant material, and is particularly concerned with body armor comprising a part specially shaped to fit over a curved area of the body such as female bust, as well as its method of manufacture.

Brief Summary Text (4):

It is known to use high tenacity fibers such as polyaramid fibers in multilayer structures to provide ballistic protection in body armor. Bullet resistant vests of multilayer structure have proven very satisfactory as body armor for men and women, but difficulties have been encountered in improving comfort for female wearers by shaping the armor to adapt to the female body.

Brief Summary Text (5):

Wearer comfort and the effectiveness of the armor to prevent injury are closely related. Depending on the protection level and the fabric type, about 10 to 50 layers of fabric are used. This produces a somewhat stiff structure that does not readily adapt to pronounced body contours, particularly over the female breast region. If the armor does not lie in snug contact with the wearer's body, shock transmission becomes uneven and the body armor does not perform as it should. The body armor's shaped areas are particularly liable to damage by shots at a glancing angle of incidence. Moreover, female breasts are specially liable to traumatic shock injury.

Brief Summary Text (6):

Various proposals for multilayer body armor specially shaped to protect shaped areas of the body such as women's breasts have already been made. But making multilayer armor in special shapes is rendered difficult due to the fact that the layers of penetration resistant material are flexible but relatively inelastic. Problems have therefore been encountered.

Brief Summary Text (11):

Shaping body armor by molding layers of aramid fabric in a PVC shell with the aid of pressure at 400-800 kPa and heat at 180-300.degree. C. has been proposed in DE-A4423194 and in WO 96/01405. However aramid fibers have an elongation up to 4% which can lead to damage in molding. Moreover, shaping the layers stretches the fabric which would increase the gaps between the fibers and reduce ballistic efficiency. Also, this

molding in a PVC shell makes the armor relatively stiff.

Brief Summary Text (12):

The above-discussed prior proposals for specially shaped multilayer body armor have therefore failed to produce a lightweight multilayer structure which fits to the body comfortably while providing excellent ballistic protection and which can be manufactured using available equipment operating at ambient temperature, or using simple thermal bonding techniques.

Brief Summary Text (17):

The invention proposes armor, in particular body armor, which is made of multiple layers of flexible relatively inelastic penetration-resistant material shaped to fit over a shaped area to be protected.

Brief Summary Text (23):

The shape produced this way enables a better fit to the body contour while imposing no restrictions on the extent of the protection provided by the multilayer structure. Due to their even distribution, the folded-over parts do not adversely affect the flexibility and comfort of the armor. Moreover, the extra weight of the folded parts is insignificant. The body armor thus remains lightweight and comfortable to wear leading to enhanced protection against injury.

Brief Summary Text (28):

Each layer of material normally has one dart, or in the case of women's specially-shaped body armor, two darts arranged symmetrically on either side of the two points or areas of convergence. It is however possible for each layer of material to have more darts, for example four darts on either side of and extending above and below the two points or areas of convergence.

Brief Summary Text (29):

A main application of the shaped armor of the invention is as body armor comprising at least one part shaped to fit over a shaped part of the body such as a torso, a neck and/or collar area, a shoulder area, or an elbow, knee or other joint area. The body armor can be soft or relatively stiff or hard armor in the form of vests or arm or leg protection and similar apparel.

Brief Summary Text (30):

A particular application is as body armor shaped to fit over the bust of a female wearer, having two laterally-spaced internally concave recessed parts corresponding to the bust. In this embodiment, the darts are angularly offset around each of the two laterally-spaced recessed parts about which said added thickness is distributed substantially evenly.

Brief Summary Text (31):

In this women's shaped body armor, the two laterally-spaced concave recessed parts corresponding to the bust are usually formed by darts around the upper, lower and outer edges of the recessed parts, defining a continuously shaped bust ("mono-cup") receiving the two breasts.

Brief Summary Text (33):

The darts of this women's shaped body armor extend radially from two laterally-spaced points or areas of convergence corresponding to the centers of the recessed parts, above and below the two points or areas of convergence, and preferably extending over an angle of at least about 180 degrees.

Brief Summary Text (34):

Body armor according to the invention in the form of a vest typically has front and rear panels permanently joined together or releasably secured for example by VELCRO fasteners, the front panel for example being shaped to fit over the bust of a female wearer by the described novel arrangement of darts. The invention concerns both the entire vest and the front panel, which may be sold separately.

Brief Summary Text (36):

For women's shaped body armor, an angle of about 15 to 30 degrees, conveniently 20 to 25 degrees, is preferred as this provides the recessed parts with a shape that is suitable for most female breasts.

Brief Summary Text (42):

As discussed in detail below, the penetration-resistant material is advantageously made

of polyaramid fibers and, to improve the penetration resistance and reduce backface deformation, one or more of the layers (typically only the back and/or front layer) may be bonded to a polymer. It is also possible for the body armor to include one or more front pockets for receiving ballistic panels, or to be associated with other protective layers, to improve the ballistic performance and/or reduce back-face deformation where needed. For example, a rigid or semi-rigid front layer could be fitted.

Brief Summary Text (45):

Consequently, one embodiment of the invention is contemplated where a multilayer structure has only a limited number of extra-reinforced layers--say three or four layers out of 10 to 50 layers in all--thereby improving the penetration resistance without leading to a problem of bulging in the area of the darts.

Brief Summary Text (50):

Various types of fibers can be applied in the penetration-resistant material used in the multilayer body armor according to the invention such as fibers comprising a polyolefin, e.g. polyethylene, polyimide, polyester or polyaramid usually having a tenacity at least 900 MPa according to ASTM D-885, which equals approximately 7 grams/denier. To provide superior penetration-resistance, preferably the tenacity of the fibers is at least 2000 MPa according to ASTM D-885.

Brief Summary Text (54):

The specific weight of such fabrics is generally from 0.02 to 0.5 kg/m.<sup>sup.2</sup>, preferably from 0.05 to 0.5 kg/m.<sup>sup.2</sup> and more preferably from 0.08 to 0.3 kg/m.<sup>sup.2</sup> in order to obtain a balance between penetration resistance and specific weight.

Brief Summary Text (59):

To improve the penetration resistance and reduce backface deformation, one or more of the layers of the above-described fabric may be bonded to a polymer layer or impregnated with a polymer in order to make use of both the properties of the fibers and the polymeric continuum. For example, several or all of the layers can have a bonded or coated reinforcing layer over a selected area, excluding the area of the darts.

Brief Summary Text (65):

The flexibility of the polymeric layer is an important factor for both the penetration-resistance of the composite and the wearing comfort of body armor incorporating one of more of the composite sheets.

Brief Summary Text (67):

A flexural modulus higher than 1000 MPa indicates a polymer that is too stiff to effectively withstand puncture or be worn comfortably as body armor, whereas a flexural modulus of less than 42 MPa indicates a material which is too flexible to provide any effective stiffness to the composition for anti-stab purposes. An additional advantage of body armor comprising such a polymer is the reduced backface deformation attained when a bullet hits the body armor.

Brief Summary Text (68):

Another significant property of the polymer layer is the density thereof, in particular in view of a desirable low specific weight (expressed in kg/m.<sup>sup.2</sup> composite) for ease of wear of body armor and for ease of handling and efficient engineering with the aim of weight reduction.

Brief Summary Text (74):

When layers of such composite fiber/polymer are included in the shaped body armor according to the invention, such sheets can be shaped using darts and folded pleats as described herein; there is no need for the application of heat during this shaping process. However, it would be possible to include one or more layers of a fiber/polymer composite pre-shaped by molding.

Brief Summary Text (88):

Firstly, the edges of the V-shaped sections are joined to form the darts in each layer, the layers with formed darts all having substantially the same peripheral shape for assembly into the body armor.

Brief Summary Text (101):

The edges of the V-shaped sections can be sewed together to form the darts, preferably using a polyaramid yarn. Alternatively, these edges could be joined by other means such as staples or rivets of polyaramid, or by gluing. The layers of impact-resistant

material are conveniently joined by sewing.

Brief Summary Text (102):

When the layers of material are attached together, care is taken to maintain the shape and to avoid the formation of air pockets. The front panel of the body armor can be made by joining together two or more packs of layers of the penetration-resistant material shaped by assembling layers with angularly offset darts as just described.

Drawing Description Text (8):

FIG. 6 is a schematic plan view illustrating how the back panel of the body armor of FIG. 1 may be assembled; and

Detailed Description Text (37):

The resulting panel is found to provide improved penetration resistance to ballistic projectiles and improved stab resistance, even when only a few of the layers have a selectively-applied reinforcing film 41 (panel B in the following Examples). When a shaped vest panel is made up with all or substantially all of the layers provided with a selectively-applied reinforcing film 41 (panel C of the following Examples), the panel is found to have a greatly improved ballistic performance and outstanding resistance to stabbing, combined with excellent wearing comfort.

Detailed Description Text (56):

The "mono-cup" body armor front panels A, B and C were filled with plastiline and subjected to standard ballistic tests by firing projectiles under controlled conditions. Shots were fired at six selected points on the shaped area, according to additional test requirements specified in the German Schutzklasse 1 standard, using 9 mm parabelum FMJ 8 g bullets. The comparative results are as follows:

Detailed Description Text (62):

The "mono-cup" body armor front panels A, B and C were filled with plastiline and subjected to standard stab-resistance tests using a blade fixed to a mass and dropped from a height corresponding to an energy of 10 Joules. The comparative results are as follows:

CLAIMS:

7. Multilayer shaped armor according to claim 1 which is body armor comprising at least one part shaped to fit over a shaped part of the body.

**WEST**[Generate Collection](#)[Print](#)**Search Results - Record(s) 1 through 15 of 15 returned.**☐ 1. Document ID: US 6534426 B1

L3: Entry 1 of 15

File: USPT

Mar 18, 2003

US-PAT-NO: 6534426

DOCUMENT-IDENTIFIER: US 6534426 B1

TITLE: Knife-stab-resistant composite

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWC
Draw Desc	Image										

☐ 2. Document ID: US 6475936 B1

L3: Entry 2 of 15

File: USPT

Nov 5, 2002

US-PAT-NO: 6475936

DOCUMENT-IDENTIFIER: US 6475936 B1

TITLE: Knife-stab-resistant ballistic article

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWC
Draw Desc	Image										

☐ 3. Document ID: US 5943694 A

L3: Entry 3 of 15

File: USPT

Aug 31, 1999

US-PAT-NO: 5943694

DOCUMENT-IDENTIFIER: US 5943694 A

TITLE: Specially shaped multilayer armor

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWC
Draw Desc	Image									

☐ 4. Document ID: US 5677029 A

L3: Entry 4 of 15

File: USPT

Oct 14, 1997

US-PAT-NO: 5677029

DOCUMENT-IDENTIFIER: US 5677029 A

TITLE: Ballistic resistant fabric articles

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KWIC

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☐ 5. Document ID: US 5472769 A

L3: Entry 5 of 15

File: USPT

Dec 5, 1995

US-PAT-NO: 5472769

DOCUMENT-IDENTIFIER: US 5472769 A

TITLE: Soft body armor material with enhanced puncture resistance comprising at least one continuous fabric having knit portions and integrally woven hinge portions

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KWIC

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☐ 6. Document ID: US 5376426 A

L3: Entry 6 of 15

File: USPT

Dec 27, 1994

US-PAT-NO: 5376426

DOCUMENT-IDENTIFIER: US 5376426 A

TITLE: Penetration and blast resistant composites and articles

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KWIC

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☐ 7. Document ID: US 5362527 A

L3: Entry 7 of 15

File: USPT

Nov 8, 1994

US-PAT-NO: 5362527

DOCUMENT-IDENTIFIER: US 5362527 A

**\*\* See image for Certificate of Correction \*\***

TITLE: Flexible composites having rigid isolated panels and articles fabricated from same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KWIC

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☐ 8. Document ID: US 5316820 A

L3: Entry 8 of 15

File: USPT

May 31, 1994

US-PAT-NO: 5316820

DOCUMENT-IDENTIFIER: US 5316820 A

**\*\* See image for Certificate of Correction \*\***

TITLE: Flexible composites having flexing rigid panels and articles fabricated from same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Drawn Desc	Image								

KWIC

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☐ 9. Document ID: US 5254383 A

L3: Entry 9 of 15

File: USPT

Oct 19, 1993

US-PAT-NO: 5254383

DOCUMENT-IDENTIFIER: US 5254383 A

TITLE: Composites having improved penetration resistance and articles fabricated from same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Drawn Desc	Image								

KWIC

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☐ 10. Document ID: US 5198280 A

L3: Entry 10 of 15

File: USPT

Mar 30, 1993

US-PAT-NO: 5198280

DOCUMENT-IDENTIFIER: US 5198280 A

TITLE: Three dimensional fiber structures having improved penetration resistance

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Drawn Desc	Image								

KWIC

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☐ 11. Document ID: US 5196252 A

L3: Entry 11 of 15

File: USPT

Mar 23, 1993

US-PAT-NO: 5196252

DOCUMENT-IDENTIFIER: US 5196252 A

TITLE: Ballistic resistant fabric articles

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Drawn Desc	Image								

KWIC

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☐ 12. Document ID: US 5187023 A

L3: Entry 12 of 15

File: USPT

Feb 16, 1993

US-PAT-NO: 5187023

DOCUMENT-IDENTIFIER: US 5187023 A

**\*\* See image for Certificate of Correction \*\***

TITLE: Ballistic resistant fabric articles

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Drawn Desc	Image								

KWIC



☐ 13. Document ID: US 5185195 A

L3: Entry 13 of 15

File: USPT

Feb 9, 1993

US-PAT-NO: 5185195

DOCUMENT-IDENTIFIER: US 5185195 A

**\*\* See image for Certificate of Correction \*\***TITLE: Constructions having improved penetration resistance

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KMC

☐ 14. Document ID: US 4574105 A

L3: Entry 14 of 15

File: USPT

Mar 4, 1986

US-PAT-NO: 4574105

DOCUMENT-IDENTIFIER: US 4574105 A

TITLE: Penetration resistant textile panels with plies of nylon and plies of Kevlar

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KMC

☐ 15. Document ID: US 4090011 A

L3: Entry 15 of 15

File: USPT

May 16, 1978

US-PAT-NO: 4090011

DOCUMENT-IDENTIFIER: US 4090011 A

TITLE: Armor

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
Draw Desc	Image								

KMC

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Term	Documents
BODY	884418
BODIES	132796
BODY	109
ARMOR	4749
ARMOUR	2787
ARMOURS	36
ARMORS	190
(1 AND (BODY ADJ ARMOR)).USPT.	15
(BODY ADJ ARMOR AND L1).USPT.	15

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L2: Entry 1 of 1

File: USPT

Dec 5, 1995

DOCUMENT-IDENTIFIER: US 5472769 A

TITLE: Soft body armor material with enhanced puncture resistance comprising at least one continuous fabric having knit portions and integrally woven hinge portions

Abstract Text (1):

A soft body armor material with enhanced puncture resistance is fabricated from knitted light weight, durable fibers, such as aramid fibers. The knitted portions are joined by interwoven portions providing an integrally formed hinge-like effect for flexibility. A deflection shield formed from a thin mesh of stainless steel or titanium wire or a sheet of light weight metal, such as titanium, with corrugations or dimples on the externally facing surface provides additional penetration resistance for sharp pointed objects. An inner resilient trauma shield and a removable moisture absorbing inner layer are also optionally included. Hollow fibers are employed in some of the layers to provide a ventilation or cooling capability, and fibers having an electrically resistive component can be employed in conjunction with a battery to provide resistance heating for warmth and moisture dissipation.

Brief Summary Text (8):

The penetration resistance capability of the soft armor material fabricated according to the invention can be enhanced by the provision of an additional inner deflection layer. The additional deflection layer can be fabricated from finely woven flat or textured metal mesh fabricated from stainless steel or titanium wire, or a relatively thin sheet of high strength material, such as titanium, having a textured surface. The textured surface of either the mesh or the sheet material is preferably corrugated or dimpled. The surface corrugations or dimples function to deflect an entering sharp pointed instrument laterally of the intended penetration direction, which tends to disperse the penetrating force by causing a tearing action on the material. In applications not requiring this lateral deflection, the layer may comprise a thin, flexible sheet of polycarbonate material.

Detailed Description Text (7):

With reference to FIG. 5, one form of such a deflection layer comprises a fine wire mesh 30 with individual strands 31 fabricated from a high strength metal wire such as stainless steel wire or titanium wire. The mesh size can vary, but a preferred size is one in the range of about 200 mesh. Also, the mesh may be substantially flat, as illustrated, or textured in the manner described below.

**CLAIMS:**

1. A soft armor material for resistance to bullets and sharp points comprising:

(a) a plurality of knitted fiber layers forming a first face of the armor material, at least one of the layers being a continuous fabric including:

(i) knitted portions having a density which provides substantial frictional resistance to sharp points, and

(ii) integrally woven hinge portions providing flexibility and energy absorption between adjacent knitted portions, and

(b) a deflection layer for enhanced penetration resistance, the deflection layer being substantially impermeable to sharp points.

13. The armor material of claim 12 wherein the metal mesh is fabricated from a material